

Before the
FEDERAL COMMUNICATIONS COMMISSION
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FEDERAL COMMUNICATIONS COMMISSION
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In the Matter of

Amendment of Parts 2, 15, and 97 of the
Commission's Rules to Permit Use of Radio
Frequencies Above 40 GHz for New Radio
Applications

ET Docket No. 94-124

To: The Commission

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**COMMENTS OF THE HEWLETT-PACKARD COMPANY
ON THE SECOND NOTICE OF PROPOSED RULEMAKING**

Hewlett-Packard Company ("HP") hereby submits comments on the Second Notice of Proposed Rulemaking in the above-referenced proceeding.¹ HP specifically comments on the issues regarding the development of a spectrum etiquette for the general unlicensed band at 59-64 GHz, and expresses its strong support for the Federal Communication Commission's ("FCC" or "Commission") decision to allow one year for industry to consider such an etiquette. HP also comments on spurious emissions and power limits for the 59-64 GHz band.

I. BACKGROUND

HP is a \$30 billion global information technology company with a long history as a manufacturer of microwave and millimeter wave test equipment. For some time HP has believed

¹ Amendment of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications. First Report and Order and Second Notice of Proposed Rulemaking, ET Docket No. 94-124, RM-8308 (released December 15, 1995).

049

that the potential uses of the millimeter wave spectrum exceed far beyond test and measurement equipment. For this reason, HP enthusiastically supports the Commission's December, 1995, decision to allocate the 59-64 GHz band for general unlicensed use under Part 15 of the Commission's rules.² In allocating the 59-64 GHz band for general unlicensed use, and in recognition of broad industry consensus in favor of permitting industry to develop technical rules to promote band sharing, the Commission delayed implementation of the rules for the 59-64 GHz band for one year in order to give industry time to consider and develop a set of access rules that would protect the band from unacceptable sources of interference.³ As discussed below, HP believes that technical rules, or an access "etiquette" will help to assure efficient use of the 59-64 GHz band. As a result, HP also strongly supports this action.

WORKING GROUP

In direct response to the FCC's decision, HP helped to develop, and now leads, the Millimeter Wave Communications Working Group ("MWCWG" or "Working Group"), an ad hoc coalition of companies that share an interest in information technology and recognize the potential importance of the unlicensed band at 59-64 GHz. The specific charter of the MWCWG is to consider and, if necessary, develop a spectrum etiquette for the 59-64 GHz band prior to the December 15, 1996 deadline specified by the Commission. The Working Group will determine by a vote of membership whether a specific set of operational rules should be recommended to the FCC and, if so, what the nature and extent of such rules should be. HP strongly believes that the activities of the Working Group are important to the success of the 59-64 GHz band, and as such

² Id. at para. 33

³ Id. at para. 64

the company is playing an active role not only by chairing the MWCWG, but also by providing both technical and administrative support to the Working Group.

II. HP STRONGLY SUPPORTS THE ALLOCATION OF THE 59-64 GHz BAND FOR GENERAL UNLICENSED USES, AND THE ONE YEAR PROCESS PROPOSED BY THE COMMISSION IN WHICH INDUSTRY WILL CONSIDER THE ADOPTION OF A SPECTRUM ETIQUETTE

HP commends the Commission for its recent allocation of 59-64 GHz for general unlicensed uses. The company believes that this sizable allocation will make it possible to provide people everywhere with an array of new high-capacity wireless products and services. HP envisions a world in the not-too-distant future in which individuals will be able to access hundreds of megabits of information per second. Clearly, the 59-64 GHz band will make possible easier, faster and less costly methods for multiple users to access and exchange information from any location, without the physical obstacles of wired networks or bandwidth limitations of lower frequency unlicensed allocations.

However, in order for the band's potential to be fully realized, non-interoperable systems must be able to co-exist and operate without unacceptable levels of interference.

The concern about interference is particularly apt in relation to the 59-64 GHz band, largely because it is part of the "oxygen absorption band" in which waves transmitted at legal power levels cannot travel beyond approximately one kilometer due to absorption by atmospheric oxygen. These natural properties protect against long-distance interference --for example, between widely separated transmitters, and in ground-to-satellite situations--making the band particularly well suited for short range communications of many types. Wireless LANs, computer interconnects, personal multi-media devices and point-to-point links are just some of the

applications that are ideally suited for the 59-64 GHz band. However, because communications are limited to short distances, many non-interoperating systems, including in some cases, competing systems, will have to be able to transmit in close physical proximity without fear of interference. HP anticipates that as more uses for the band are developed, certain physical locations on the band will become increasingly crowded and, just as in the case of public roadways, some common rules may be necessary in order to prevent chaos.

This is why HP believes that it is so important to participate in a deliberative process through which a broadly representative group of potential users of the 59-64 GHz band can consider the development of a spectrum etiquette. HP, therefore, supports the Commission's decision to give industry one-year in which to accomplish this task.

If indeed, it is proven necessary to establish operational rules for the band, the rules should, in no way, inhibit operation within the band. HP believes that it is vitally important that any operational rules adopted be flexible enough to allow as many applications as possible to co-exist in the band, and to easily accommodate future technologies as they emerge. While it is not realistic to expect any set of rules to completely eliminate every form of interference one hundred percent of the time, HP believes that an etiquette can, and should provide a substantial reduction in the probability of interference between co-existing but non-interoperating systems. In fact, HP believes that truly effective use of this unlicensed spectrum actually may be dependent on a set of minimal rules that provides a structure for co-existence of systems from multiple manufacturers, providing a wide variety of services.

III. AN INDUSTRY-LED PROCESS IS THE BEST WAY TO ENSURE THAT AN EFFECTIVE PLAN IS DEVELOPED TO MINIMIZE UNACCEPTABLE INTERFERENCE IN THE 59-64 GHz BAND

HP is playing a leadership role in the work of the MWCWG to develop a consensus proposal of technical rules for the FCC's consideration. HP is fully committed to this effort, and is backing up our commitment with our most important asset: people with technical expertise. HP has designated several key professionals, whose time is being diverted from important HP research projects, to lend their skills and knowledge and to work with other industry leaders on the development of a plan that will minimize interference in the 59-64 GHz band. HP has made this business decision because it believes that it is critically important to the future success of potential products operating in the 59-64 GHz band.

HP also firmly believes the best way to accomplish the task of considering, and if necessary developing an access etiquette is through the direct involvement of the companies that hope to develop devices or systems for use in the 59-64 GHz band. The company believes that the MWCWG is in the best position to identify future needs, assess technical and economic considerations, and draw conclusions on the risks and benefits of any such rules. Furthermore, the MWCWG provides a singularly focused forum within which a range of theories and proposals on the nature and extent of necessary rules can be debated and tested. HP is confident that this is the best approach to ensuring that a widely-inclusive, easily implemented, workable set of technical rules can be developed in a timely manner. Using the MWCWG as a focal point for this effort also provides the Commission the benefit of receiving the collective best thinking of industry experts, without having to sort through and ascertain the feasibility of widely diverse proposals from various sources.

In order for this approach to be truly successful, HP recognizes that the process must be open and inclusive of many different opinions. The MWCWG has taken steps to ensure that it communicates regularly with many interested parties, and as the leader of the Working Group HP is committed to ensuring that the MWCWG continues to be receptive and open to a wide variety of inputs. HP is also committed to keeping the Commission informed on a regular basis about the progress of the Working Group.

IV. HP BELIEVES THAT INDUSTRY WILL ACCOMPLISH ITS CONSIDERATION OF AN ETIQUETTE IN THE ONE YEAR PERIOD PROVIDED BY THE COMMISSION, AND THAT THIS PERIOD WILL NOT UNREASONABLY DELAY INTRODUCTION OF PRODUCTS INTO THE 59-64 GHz BAND

HP supports the Commission's decision to give industry a fixed, one year period to deliberate possible technical rules for the 59-64 GHz band. HP believes that one year is a reasonable period within which to accomplish this work, and will not unreasonably delay the introduction of new products in the band.

Since its formation in February 1996, the MWCWG has met regularly, and has already made substantial progress toward achieving a consensus on the content of the proposed technical rules. To the best of HP's knowledge, most of the companies that will be deploying products in the 59-64 GHz band in the near future are either participating in the MWCWG or have indicated an intention to do so. HP is confident that the Working Group is highly motivated and will be able to complete its work by the deadline imposed by the Commission. As the company chairman of the Working Group, HP is committed to ensuring that the group meets its goal. Therefore, HP encourages the Commission to adhere to its decision of providing industry one year within which to consider a spectrum etiquette.

HP supports the industry-led process not only due to the necessity of minimizing interference in the 59-64 GHz band, but also because this process will assist tremendously in the ability to use the 59-64 GHz band internationally -- a goal shared by both the Commission and industry. In fact, the U.S. Government and industry, working together, have an opportunity to take the lead globally in developing a framework for operating rules that could be adopted by other countries or used to form the basis for foreign governments' efforts to develop standards for the band. This is an important step in promoting global markets for new products. If international harmonization of the 59-64 GHz band is achieved, the value and usefulness of this spectrum will increase significantly.

HP and other MWCWG representatives have met with government and industry groups in Europe and Japan to discuss the work being done in the United States to open the 59-64 GHz band for commercial purposes. There is a great deal of interest around the world in the potential of the band, and other countries are keenly observing the activities of U.S. industry and looking to the U.S. government for leadership. Japan, in particular, has made some important advances in the millimeter wave technologies. Accordingly, the Japanese Ministry of Posts and Telecommunications ("MPT") has been especially interested in the work of the MWCWG. A senior staff representative of the Association of Radio Industries and Business ("ARIB"), the government and industry standards body for millimeter wave bands, has been designated to serve as an official liaison to the MWCWG. In return, several U.S. companies, including HP, have been invited to participate in the ARIB standards activities, which HP believes will have the effect of promoting important information exchange as well as allowing U.S. companies an opportunity to help lead simultaneous country efforts toward international harmonization.

HP urges the FCC to recognize the importance of international communications in developing efficient use of the 59-64 GHz band and to remain steadfast in its decision to allow industry until the end of the year to reach a consensus on operational parameters for the band.

V. **IF IT CONCLUDES THAT AN ETIQUETTE IS NECESSARY, THE COMMISSION SHOULD ADOPT A SINGLE RECOMMENDATION FOR THE 59-64 GHz BAND**

In the Second Notice, the Commission sought comment on whether multiple etiquettes should be adopted, and whether an etiquette proposed by industry could co-exist with other etiquettes. HP strongly believes that harmonious use of the band can occur only through adoption of a single set of operating rules in which all elements are compatible. The best way to ensure this would be to adopt a single, well-considered recommendation from a study group, such as the MWCWG. While the MWCWG has not yet determined a particular etiquette to propose the FCC, it has expressed the opinion that multiple non-compatible etiquettes would create confusion in the band, and would undermine the benefits of developing any etiquette at all.

It is HP's view, however, that flexibility should be considered a foremost goal in etiquette development. Any etiquette that is adopted, if based on flexible rules, will provide the benefits of multiple etiquettes--that is, accommodating a wide range of types of uses and technologies--without the negative consequences multiple, non-compatible etiquettes would have on efficient, harmonious band operation.

VI. POWER LIMITS SHOULD BE CONSISTENT ACROSS THE 59-64 GHz BAND, AND PEAK-TO-AVERAGE POWER RATIO SHOULD BE REDUCED

In its Second Notice, the Commission did not specifically seek comment on the issue of power limitations for the 59-64 GHz band. However the Commission should be aware that HP has two concerns about power emissions in the 59-64 GHz band: ISM band emissions from non-communications devices, and high peak powers that would be allowed under the Report and Order.

ISM BAND POWER

The operation of high-power devices in the 61-61.5 GHz ISM band could pose interference problems to communications devices using the broader 59-64 GHz band. HP believes that the power limits established for communications devices using the 59-64 GHz band should be consistently applied across the band, including all ISM devices in the 61-61.5 GHz band. HP believes it is important to ensure that the ISM band does not become a de facto refuge for unlimited-power devices.

HP also notes that, to the best of its knowledge, no ISM devices are currently operating in the 61-61.5 GHz ISM band. Consequently, the best opportunity to clarify consistency in power limitations across the 59-64 GHz band without interrupting any particular products would be prior to finalizing the rules for the 59-64 GHz band. HP urges the Commission to consider this matter, and take action in a timely manner.⁴

⁴ See Letter to Mr. Richard Smith, Chief, Office of Engineering and Technology, FCC, from Richard D. Parlow, Associate Administrator, NTIA (Dated April 12, 1995).

PEAK POWER LIMITS

In its First Report and Order,⁵ the Commission followed HP's suggestion to measure AVERAGE power, not PEAK power. However, the Commission also invoked the general Part 15 peak-to-average power limit of 20dB.

Allowing a 20 dB [100x] peak-to-average ratio would open the door for extremely high power pulses with interference ranges in excess of that of most communications devices, since most devices would use relatively low peak-to-average power ratios. Under the ruling as written, 1000W EIRP peak power would be allowed. HP believes that such high power would be detrimental to productive use of the 59-64 GHz band. A more modest peak-to-average ratio could allow certain modulation types to function effectively, while not posing an undue problem for interference.

HP recommends that the Commission clarify the final version of its rules to require that the legal maximum PEAK power shall be twice the present legal maximum AVERAGE POWER.⁶

This choice should allow modulations such as on/off keying to operate at the maximum average power limit without penalty, while still preventing giant pulses which could cause undue interference. Modulations with high peak-to-average ratios could still operate, but would be required to do so at reduced average power.

⁵ See: First Report and Order, page 45, Sections 15.255b and e

⁶ Specifically: AVERAGE emissions shall not exceed 9uW/CM² at a distance of 3 meters, and PEAK emissions shall not exceed 18 uW/cm² at a distance of 3 meters.

VII. TESTING OF 59-64 GHz EQUIPMENT ABOVE 200 GHz IS UNNECESSARY AS THERE ARE NO HARMONICS OF FREQUENCIES TO INTERFERE WITH RADIO ASTRONOMY USES

In its Second Notice of Proposed Rulemaking, The Commission requests comment on out-of-band emissions, with special concern for interference into bands above 200 GHz, the 217-231 GHz radio astronomy band in particular. HP points out that the 3rd harmonic of the 59-64 GHz band is the range 177-192 GHz, and the 4th harmonics are in the range 236-256 GHz. Therefore, no spurious emissions are likely into the 192-236 GHz frequency range from 59-64 GHz transmitters.

Consequently, HP recommends that 59-64 GHz equipment should be exempt from testing for spurious emissions above 200 GHz.

CONCLUSION

HP appreciates the Commission's diligence to date in opening the 59-64 GHz band for general unlicensed operation. The company believes that this allocation provides potentially important opportunities for U.S. industry.

HP believes that in order to take advantage of the full benefits of the band, there must be a flexible set of access rules that minimizes the probability of radio interference in the band. HP supports the Commission's decision to allow industry one year in which to consider the nature and extent of such rules, and encourages the Commission to adhere to its decision. Should the Commission at the end of this one year period conclude that there should be an etiquette for the 59-64 GHz band, HP supports adoption of a single etiquette.

HP believes believe that power limitation should be consistently applied across the 59-64 GHz band, including the ISM band at 61-61.5 GHz.

HP also urges the Commission to reduce the peak-to-average power ratio for the 59-64 GHz band to 3dB.

Lastly, HP asserts that no testing should be required of 59-64 GHz equipment above 200 GHz since no harmonics of frequencies in that band fall into the 217-231 GHz radio astronomy window.

Respectfully submitted,

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